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(54) Title: TEXTURE-ENHANCED SNACK FOOD

(57) Abstract

A texture-enhanced snack product prepared, in one embodiment, by applying a hydrated batter precoat and a layer of edible particulates to an expanded edible base material containing up to 20 % by weight moisture, heating to drive off moisture introduced by the batter, applying fat and baking. In an alternate embodiment, a texture-enhanced snack product, as above, in which the fat is applied to the edible particulates before they are applied to the precoat layer and the heating step is eliminated.

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TEXTURE-ENHANCED SNACK FOOD

BACKGROUND OF THE INVENTION

This invention relates generally to snack foods typically prepared by processes including a frying step. More particularly, this invention relates to a uniquely textured non-fried snack food and to its method of manufacture.

Since their inception, full-fat snack foods have been evolving into ever-improving products. From the simplest of snacks like potato chips and popcorn through more complicated extruded snack products, current snack foods can be categorized into four generations of development.

First Generation Snacks

The first generation snacks, which are the most traditional of snack items, are made from a single whole ingredient. First generation snacks are usually produced by a means other than extrusion. Typical of these snacks are potato chips, popcorn and nuts.

Second Generation Snacks

Second generation snacks differ from first generation snacks in that they are made from one or more base ingredients not in their whole form. Second generation snacks may be expanded or unexpanded. In some cases, a frying and/or a baking step is used to give the product its final textural qualities. Classic examples of second generation snacks include corn curls (expanded), tortilla chips (unexpanded) and corn chips (unexpanded).

Extrusion equipment can be used to produce a second generation snack in the form of an expanded farinaceous material. In the extrusion process, the products are expanded, shaped and sized at the extrusion die. No further expansion is required.

Seasoning of second generation snacks can be achieved through application of a topical dry or oil slurry application.

Third Generation Snacks

Combining cereal products and starches into mixtures which are subjected to successive processing stages gives rise to a third generation of snacks. Typical of this category are pellets or half-products which require two steps to define the shape of the finished product. The extrusion process differs from that used in producing a second generation snack in that a primary extruder gelatinizes the ingredients creating certain restrictions on the dough mass. A secondary extruder can be used to densify, shape and cool the dough through a final die.

This dense material, which contains from 20-30% moisture by weight, is then processed through a dryer at a selected time and temperature to achieve a final 10-12% moisture level. The resulting pellets can be packaged with ultimate expansion to be carried out by a processor or they can be stored in a climate controlled area for 24 hours, further expanded by hot air or hot oil, and seasoned.

Third generation snacks combine shapes and ingredients to yield the widest variety of currently available snack foods.

Fourth Generation Snacks

Fourth generation snacks are described in U.S. Patent No. 5,188,855. These snacks are prepared using a substrate in the form of an expanded farinaceous material containing up to about 20% by weight moisture, applying a batter or precoat followed by a breading, baking and then frying. The resulting relatively low fat product has superior texture, appearance and taste.

Texture-Enhanced Snack Product

The present inventors have determined that there is a need in the art for yet another expanded farinaceous-based snack product which is relatively low in fat yet has a particularly satisfying enhanced texture.

Accordingly, it is an object of the present invention to provide a new non-fried expanded farinaceous snack product with unique texture characteristics superior to those present in conventional second, third or fourth generation snacks.

It is another object of the present invention to provide an expanded snack product

which has been battered, coated with a wide range of different particulates, and baked but not fried.

It is a still further object of the present invention to provide a snack product with low fat content.

It is yet another object of the present invention to provide a new generation of snack which represents an important improvement beyond second, third, and fourth generation snacks.

Other objects and advantages of the invention will appear hereinafter.

SUMMARY OF THE INVENTION

The present invention comprises a texture-enhanced baked snack product prepared using an expanded farinaceous substrate to which a hydrated batter precoat is applied, followed by a layer of edible particulates. In a preferred embodiment, the application of the particulates is followed by heating to drive off the moisture introduced by the hydrated batter precoat, after which a coating of a fat is applied. In an alternative embodiment, the fat is applied to the edible particulates before they are applied to the precoat layer. In this embodiment, the intermediate heating step is eliminated. In both embodiments, preparation of the product is completed in a final baking step. The invention purposefully avoids frying following application of the edible particulates since frying would introduce undesirable levels of fat and would burn or otherwise degrade the particulates.

DETAILED DESCRIPTION OF THE INVENTION

Expanded farinaceous substrates useful in the practice of the invention include any expanded farinaceous material initially containing up to 20% by weight moisture which maintains its integrity on immersion in the hydrated batter precoat used in the method of the invention. In a more preferred embodiment, the initial moisture level of the substrate will be less than about 10% by weight and, in a most preferred embodiment, the substrate initially will contain less than about 5% by weight moisture.

One group of particularly useful base materials includes expanded farinaceous second or third generation snacks which maintain their integrity on immersion in the liquid precoat mixture. Preferred second generation products include expanded corn, rice, potato, oat and

wheat, or combinations of two or more thereof. Preferred third generation products include pellets and half-products that are further expanded corn, oat and wheat, or combinations of two or more thereof. Among the noted second and third generation materials, expanded corn is most preferred.

The hydrated batter precoat comprises water and a dry batter mixture. The ratio of water to the dry batter mixture should not exceed about 3:1 by weight water to dry mix, and preferably will be about 2:1. In a preferred embodiment, soft wheat flours are used. Preferred flours include yellow corn flour and soft wheat flour. The preferred starch is modified corn starch. The preferred dextrin is corn dextrin. Preferred gums include xanthan, guar, and carrageenan. Optional additional dry ingredients include leavening, coloring, and flavoring agents.

The edible particulates may be chosen from among: breadings; granulated cereal products such as cracker and cookie crumbs, cornflake crumbs and pre-cooked cereal crumbs; particulated dehydrated vegetables and fruits; and, chopped nutmeats. Preferably, the edible particulates will not contain any significant amounts of dairy protein, and in any event the particulates should contain less than about 30% by weight dairy protein, on a dry basis.

It is preferred that the particulates be dried to a moisture level of less than about 10 percent by weight water. The optimal size of the edible particulates will depend upon the shape and size of the substrate since larger particulates will tend to pull away from sharp radii or corners on the substrate surface. In any event, the particulates should be less than about 0.65cm in their largest cross-sectional dimension. Further, if the particulates are too fine they tend to seal the surface of the substrate, preventing release of moisture, particularly in the preferred embodiment of the invention which includes a heating step before application of the fat.

When breadings are used in the edible particulate layer, they may be colored or uncolored, and Japanese or homestyle. Most preferred are fine Japanese-style crumbs as described in the present assignee's U.S. Patent No. 4,423,078, since these breadings exhibit outstanding appearance and textural qualities over a broad range of substrates. Combinations of breadings may be used.

Breadings may be combined with the other edible particulates in the particulates

layer. When edible particulates other than breadings are used, they may be used alone or any two or more different non-breading particulates may be combined, as desired.

When the layer of edible particulates comprises exclusively or primarily breading, the hydrated batter precoat will generally include starches, flour, gums, dextrin and water in the following ranges, in percent by weight:

<u>Components</u>	<u>Broad Range</u>	<u>Preferred Range</u>
Starch	0-70	10-20
Wheat flour	0-60	35-45
Corn flour	0-60	40-50
Gum	0-2	0-0.5
Dextrin	0-80	0-20
Water	30-90	50-75

One hydrated batter precoat which has been found to be particularly useful when using breading exclusively or primarily in the edible particulates layer contains:

<u>Component</u>	<u>Percentage By Weight</u>
Sodium bicarbonate	0.20
Sodium aluminum phosphate	0.20
Modified corn starch	2.45
Yellow corn flour	15.17
Soft wheat flour	13.43
Coloring	1.12
Salt	0.77
Water	66.66

As those skilled in the art may readily determine, the above hydrated batter precoat compositions will have to be adjusted on a case-by-case basis to insure optimal adhesion of edible particulates other than breadings. For example, less porous and more dense particulates will require hydrated batter precoat with greater adhesion properties than

required with breadings. This may be achieved, for example, by increasing the levels in the batter of starch, wheat flour, or dextrin.

The substrate is prepared by applying the hydrated batter precoat by conventional means such as by spraying or dipping, and then applying a uniform layer of edible particulates. It is preferred, in the case of particulates in the form of breadings, to achieve a particulate pick-up level of about 10 to 35 percent by weight based upon the combined weight of the substrate and the applied precoat. The preferred pick-up level is about 25 percent by weight.

In the preferred embodiment of the invention, application of the particulate layer is followed by heating to drive off at least about 75% by weight of the moisture introduced by the hydrated batter precoat. This intermediate heating step may be carried out in a conventional oven or in a microwave oven. In a conventional oven, for example, the product may be heated by baking at a lower temperature for a longer period of time or at a higher temperature for a shorter period of time. For example, using expanded corn as the substrate, a precoat containing about 67% water and a breading as the particulate, the intermediate heating step may be carried out in a convection oven at 190°C for 3 minutes and 45 seconds or at 260°C for 45 seconds.

The intermediate heating step is followed by the application of 10-35% by weight, based on the weight of the final baked product, of an edible fat which has a melting point of less than about 43°C and is a liquid as applied. The level of fat preferably will be at a level of about 10-15% by weight. The fat may be any edible fat which is either a liquid at room temperature or can be made sufficiently fluid by heating to be applied as a liquid. Examples of fats which may be used include partially hydrogenated soybean oil, cottonseed oil, canola oil, corn oil and peanut oil.

In an alternative embodiment, the fat will be applied to the particulates before they are applied over the precoat layer. In this embodiment, the intermediate heating step will not be used since moisture introduced in the hydrated batter precoat will be driven off during the final baking step without interference from a fat coating.

In both embodiments of the invention, as described above, once the fat is introduced (by coating after application of the particulates layer or by coating the particulates before application of the particulates layer), the product will be subjected to a final baking step in

order to achieve the desired color, texture and other organoleptic properties and to reduce the level of moisture of the final product to less than 5% by weight and preferably less than 2% by weight.

Finally, the snack product of the present invention may be flavored and colored by adding the desired flavorings, seasonings, and colorings to any one or more of the batter, the particulates, the fat, or the final product after completion of the final baking step.

The following examples are intended to illustrate the practice of the present invention. These examples are not intended to be exhaustive or limiting of the invention.

Example 1

An expanded snack product in accordance with the present invention was prepared and tested as described below.

Expanded corn balls about 1.3-1.9cm in diameter were used as the substrate in this example. The corn balls, which were second generation snacks as described earlier, had a moisture level of about 5% by weight.

A hydrated batter precoat was prepared from a dry batter mix comprising the following:

Sodium bicarbonate (granular)	.60%
Sodium aluminum phosphate	.60%
Modified corn starch	7.35%
Yellow corn flour	45.50%
Soft wheat flour	40.30%
Coloring agents	3.35%
Fine flake salt	2.30%

Sufficient water was added to the dry batter mix to achieve a ratio by weight of water to dry batter of about 2:1.

The expanded corn balls were coated with the precoat mixture by dipping the expanded balls into the hydrated batter precoat for about five seconds. Following application of the precoat mixture, a uniform layer of fine Japanese-style crumbs as described in U.S. Patent No. 4,423,078 was applied using a crumb breader machine. The resulting product was heated for about 1 minute at 260°C in an intermediate heating step

in which in excess of 75% by weight of the water introduced in the precoat was driven off. Then, soybean oil was applied by brush and the balls were baked in a final baking step for an additional 3 minutes and 45 seconds at 190°C.

The resulting product had good uniform color and good texture, both on the surface and within the corn ball. It was also relatively low in fat and organoleptically particularly pleasing.

Example 2

In this example, the same substrate, particulates and fat were used as in Example 1. However, the soybean oil was sprayed onto the breadding itself, before the breadding was applied to the precoat layer, to achieve a fat level of 15% by weight, based upon the weight of the final baked product. The expanded balls were not heated following application of the particulates. The final baking step was carried on in a convection oven for about 4 minutes and 55 seconds at 190°C to reduce the moisture in the final product to less than about 2% by weight.

The resulting product was nearly as good as that obtained in Example 1, with only slightly lighter and less uniform color.

Example 3

In this example, adhesion of walnut pieces to expanded cornballs (as described in Example 1) were examined. The walnut pieces had a moisture level of about 7 percent by weight. In these tests, the heating step was dispensed with and the final baking step, as described in Example 1, was used.

In the first run, walnut pieces having a largest dimension of about 1.3cm were dipped in the hydrated batter precoat of Example 1. This combination produced poor pickup.

In the next run, the water level of the hydrated batter precoat was reduced to a ratio of 1 part dry mix to 1.75 parts water and the size of the walnut pieces was reduced to a largest dimension of about 0.3cm. Acceptable adherence was obtained in this run.

In the next run, a hydrated batter precoat having the following dry ingredients was used:

Maltodextrin (Dextrose equivalent 10)	10%
Maltodextrin (Dextrose equivalent 1)	78%
Tapioca dextrin	10%
Salt	1%
Soybean oil	1%

This combination produced very good pickup, superior to that of the previous run.

If cornballs treated as described in the latter two runs were prepared in accordance with the invention (including the heating step), the resulting product would have good uniform color and good texture, both on the surface and within the cornballs. The final product would also be relatively low in fat and organoleptically pleasing.

While the present invention is described above in connection with preferred or illustrative embodiments, these embodiments are not intended to be exhaustive or limiting of the invention. Rather, the invention is intended to cover all alternatives, modifications, and equivalents included within its spirit and scope, as defined by the appended claims.

WHAT WE CLAIM IS:

1. A method of making a texture-enhanced snack product comprising:
providing an expanded farinaceous substrate containing up to 20% by weight moisture;
applying a hydrated batter precoat;
applying a layer of edible particulates;
heating to drive off at least 75% by weight of the moisture introduced by the hydrated batter precoat;
applying an edible fat; and
baking to reduce the level of moisture in the final product to less than about 5 percent by weight.
2. The method of claim 1 in which the expanded farinaceous substrate is chosen from the group consisting of expanded corn, rice, potato, oat, wheat or combinations of two or more thereof, pellets and half products that are further expanded corn, rice, potato, oat, wheat and combinations of two or more thereof.
3. The method of claim 1 in which the expanded farinaceous substrate is expanded corn.
4. The method of claim 1 in which the expanded farinaceous substrate has a moisture content of up to about 10% by weight.
5. The method of claim 1 in which the expanded farinaceous substrate has a moisture content of up to about 5% by weight.

6. The method of claim 1 in which the hydrated batter precoat comprises the following components, in percent by weight:

Starch	0-70
Wheat flour	0-60
Corn flour	0-60
Gum	0-2
Dextrin	0-80
Water	30-90

7. The method of claim 1 in which the hydrated batter precoat comprises the following components, in percent by weight:

Starch	10-20
Wheat flour	35-45
Corn flour	40-50
Gum	0-0.5
Dextrin	0-20
Water	50-75

8. The method of claim 1 in which the hydrated batter precoat comprises a mixture of water and dry batter ingredients, the water and dry batter ingredients being present in a weight ratio of up to about 3:1 water to dry ingredients.

9. The method of claim 1 in which the hydrated batter precoat comprises a mixture of water and dry batter ingredients, the water and dry batter ingredients being present in a weight ratio of up to about 2:1 water to dry ingredients.
10. The method of claim 1 in which the edible particulates are chosen from the group consisting of: breadings; granulated cereal products such as cracker and cookie crumbs, cornflake crumbs and pre-cooked cereal crumbs; particulated dehydrated vegetables and fruits; and, chopped nutmeats.
11. The method of claim 1 in which the edible particulates are a breading.
12. The method of claim 1 in which the edible particulates contain less than about 30% by weight dairy protein.
13. The method of claim 1 in which the edible particulates contain less than about 10% by weight water.
14. The method of claim 1 in which the edible particulates are less than about 0.65cm in their largest cross-sectional dimension.
15. The method of claim 1 in which the edible particulates are breadings and a pick-up level of about 10 to 35 percent by weight is achieved, based upon the combined weight of the substrate and the applied hydrated batter precoat.

16. The method of claim 1 in which the edible particulates are breadings and a pick-up level of about 25 percent by weight is achieved, based upon the combined weight of the substrate and the applied hydrated batter precoat.

17. The method of claim 1 in which about 10 to 35% by weight fat is used, based upon the weight of the final baked product.

18. The method of claim 1 in which about 10 to 15% by weight fat is used, based upon the weight of the final baked product.

19. The method of claim 1 in which the product is baked to reduce the level of moisture in the final product to less than about 2% by weight.

20. The method of claim 1 in which flavorings, seasonings and colorings are added to one or more of the liquid precoat mixture, the breading or the fat.

21. A method of making a texture-enhanced snack product comprising:
- providing an expanded farinaceous substrate containing up to 20% by weight moisture;
 - providing a quantity of edible particulates;
 - applying an edible fat to the edible particulates;
 - applying a hydrated batter precoat to the expanded farinaceous substrate;
 - applying a layer of the fat-coated edible particulates to the expanded farinaceous substrate; and
 - baking to reduce the level of moisture in the final product to less than about 5 percent by weight.
22. A texture-enhanced snack product prepared by the process comprising:
- providing an expanded farinaceous substrate containing up to 20% by weight moisture;
 - applying a hydrated batter precoat;
 - applying a layer of edible particulates;
 - heating to drive off at least 75% by weight of the moisture introduced by the hydrated batter precoat;
 - applying an edible fat; and
 - baking to reduce the level of moisture in the final product to less than about 5 percent by weight.

23. A texture-enhanced snack product prepared by the process comprising:
- providing an expanded farinaceous substrate containing up to 20% by weight moisture;
 - providing a quantity of edible particulates;
 - applying an edible fat to the edible particulates;
 - applying a hydrated batter precoat to the expanded farinaceous substrate;
 - applying a layer of the fat-coated edible particulates to the expanded farinaceous substrate; and
 - baking to reduce the level of moisture in the final product to less than about 5 percent by weight.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US95/07701

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : A21D 13/00

US CL : 426/94

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 426/94, 89, 96, 273, 293, 296, 550, 559, 560, 439, 440, 496, 808

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS

search terms: batter, breading, corn, rice, potato, oat, wheat, coat, farinaceous substrate, snack, fat coating

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5,188,855 (BERNACCHI ET AL.) 23 February 1993, see col. 2-3 and example 1.	1-23
Y	US, A, 4,068,009 (RISPOLI ET AL.) 10 January 1978, see col. 3, lines 31-40.	1-23
A	US, A, 4,499,113 (MOCHIZUKI ET AL.) 12 February 1985, see entire document.	1-23
A	US, A, 4,588,600 (SUDERMAN) 13 May 1986, see entire document.	1-23
A	US, A, 4,421,770 (WIKER ET AL.) 20 December 1983, see entire document.	1-23
A	US, A, 4,834,996 (FAZZOLARE ET AL.) 30 May 1989, see entire document.	1-23

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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